



Payload Processing and Development (including APEX & VPU)



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Engineering Team: Life Sciences Services Contract (LSSC) at KSC

Objectives:

- Complete Advanced Plant EXperiments on-orbit – Cambium (APEX-Cambium) payload development in conjunction with the Canadian Space Agency (CSA) and International agreements to include the NASA sponsored Transgenic Gene Expression System (TAGES) experiment.
- Perform Flight Integration activities for return of the Vegetable Production Unit (VPU) samples from ISS in support of Principal Investigator Gail Bingham, Ph. D., from Utah State University (USU).
- Increase Technology Readiness Level (TRL) through flight demonstration of sensors, system components, etc.
- Support ESMD payload developers to complete off-line processing at KSC and DFRC.
- APEX-Cambium experiment specific objectives:
 - Cambium: Determine the role of gravity in Cambium wood cell development.
 - TAGES: Demonstrate non-destructive reporter gene technology & investigate spaceflight plant stress.

Relevance/Impact:

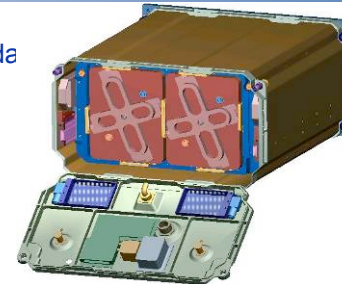
- Technology demonstration is a critical element in increasing the TRL. The NASA/LSSC team has over 40 successful flight experiments and provides the Agency with efficiencies in cost and schedule as well as the experience of all previous biological payload's launch site processing.
- Payload processing at the SLS Lab provides full biological and chemical capabilities.
- APEX-Cambium payload will provide NASA and the ISS community a permanent controlled environment capability to support growth of various organisms (i.e. whole plants). Also, as a result of the TAGES experiment Green Florescent Protein (GFP) imager development, ISS partners will benefit from a modern biological analysis capability that can provide real time non-destructive gene expression data which can ultimately optimize ISS microgravity biological experimentation and greatly reduce required specimen downmass.
- The Cambium experiment will provide the pulp & paper and construction industries insight into the fundamental mechanisms of wood cell formation.
- The TAGES experiment will demonstrate non-destructive GFP reporter gene technology and improve the understanding of spaceflight stresses on terrestrial organisms.

Development Approach:

- Utilize the NASA/LSSC payload development team to perform technology flight demonstration of ESMD/ETDP technologies developed at KSC or other Centers as funded.
- APEX-Cambium will complete Advanced Biological Research System (ABRS) final hardware assembly, ground and flight safety packages, ISS hardware verification, flight documentation \ deliverables, science verification tests, payload verification test.
- VPU will complete Shuttle return manifest and associated ISS / STS integration products.

APEX-Cambium Project Life Cycle Schedule

Milestones	CDR	Ph3 FSR	PVT	Launch	Ops	Return	Final Report
Actual/ Baseline	1/2005	TBA	5/2008	2J/A (STS-127)	L to L+6 wks	Ops +4 m	Return + 12m



Kennedy Space Center



(Top Left) Adv. Bio. Research Sys. (ABRS) used in APEX-Cambium.
 (Bottom Left) Cambium plants during Science Verification Test (SVT).
 (Top right), GFP image of TAGES plants during SVT. (Bottom right)
 VPU plant varieties as grown on ISS in the Russian LADA.

APEX-Cambium ISS Resource Requirements

Accommodation (carrier)	Middeck locker and CTB
Upmass (kg) (w/o packing factor)	38.9
Volume (m³) (w/o packing factor)	0.073
Power (kw) (peak)	0.320
Crew Time (hrs) (installation/operations)	7.25
Launch/Increment	2J/A/Increments 18&19